46. Gentile AT, Lee RW, Moneta GL, Taylor LM, Edwards JM, Porter JM. Results of bypass to the popliteal and tibial arteries with alternative sources of autogenous vein. J Vasc Surg 1996;23:272-9; discussion 279-80.
47. Green RM, Abbott WM, Matsumoto T, Wheeler JR, Miller N, Veith FJ, et al. Prosthetic above-knee femoropopliteal bypass grafting: five-year results of a randomized trial. J Vasc Surg 2000;31:417-25.
48. Johnson WC, Lee KK. A comparative evaluation of polytetrafluoroethylene, umbilical vein, and saphenous vein bypass grafts for femoral-popliteal above-knee revascularization: a prospective randomized Department of Veterans Affairs cooperative study. J Vasc Surg 2000;32:268-77.
49. Albers M, Battistella VM, Romiti M, Rodrigues AA, Pereira CA. Meta-analysis of polytetrafluoroethylene bypass grafts to infrapopliteal arteries. J Vasc Surg 2003;37:1263-9.
50. Tetteroo E, van der Graaf Y, Bosch JL, van Engelen AD, Hunink MG, Eikelboom BC, et al. Randomised comparison of primary stent placement versus primary angioplasty followed by selective stent placement in patients with iliac-artery occlusive disease. Dutch Iliac Stent Trial Study Group. Lancet. 1998;351:1153-9.
51. Norgren L, Hiatt WR, Dormandy JA, Nehler MR, Harris KA, Fowkes FG. Inter-society consensus for the management of peripheral arterial disease (TASC II) J Vasc Surg 2007;45(1 Suppl):S5-67.
52. Kavanagh T, Hamm LF, Beyene J, Mertens DJ, Kennedy J, Campbell R, et al. Usefulness of improvement in walking distance versus peak oxygen uptake in predicting prognosis after myocardial infarction and/or coronary artery bypass grafting in men. Am J Cardiol 2008;101:1423-7.
53. Myers SA, Johanning JM, Stergiou N, Lynch TG, Longo GM, Pipinos II. Claudication distances and the Walking Impairment Questionnaire best describe the ambulatory limitations in patients with symptomatic peripheral arterial disease. J Vasc Surg 2008;47:500-5.
54. Murphy TP, Soares GM, Kim HM, Ahn SH, Haas RA. Quality of life and exercise performance after aortoiliac stent placement for claudication. J Vasc Interv Radiol 2005;16:947-53.
55. Nylaende M, Abdelnoor M, Stranden E, Morken B, Sandbaek G, Risum O, et al. The Oslo balloon angioplasty versus conservative treatment study (OBACT)–the 2-years results of a single centre, prospective, randomised study in patients with intermittent claudication. Eur J Vasc Endovasc Surg 2007;33:3-12.

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DISCUSSION

Dr Karl Illig (Rochester, NY). I am a big fan of this concept, and congratulate you on pursuing this. Maybe everyone else in the room is ahead of me, but I only became aware of this issue a few years ago when patients started showing up unable to pursue aggressive cardiac rehabilitation because they couldn't walk. Your analysis is great, but it is fairly mathematical. I now consider inability to complete cardiac rehabilitation a pretty good indication for aggressive revascularization. Do you share this bias?

Dr John V. White. I agree with you. I think that this is an excellent indication for invasive intervention in the claudicant. We needed to establish a database, which is why we undertook the mathematical analysis. We are carefully following these patients and we will report our clinical results in the future.

Dr Anil Hingorani (Brooklyn, NY). I'd like to actually reflect on those comments. I think we have a very active cardiac rehab program and we have had the same type of issues where patients are not able to complete their cardiac rehab program because of their claudication. I am concerned, though, in your Markov model you only resulted in 41 lives per 10,000 patients who would benefit from this? The number seems somewhat small in terms of you have to do 10,000 patients to get 41 patients to benefit.

Dr White. We were looking strictly at mortality. Our hypothesis stated that if you cannot reduce patient mortality through cardiac rehab and you did nothing, those patients remain at high risk. So the initial passthrough of the Markov model, which is indeed quite complex, was simply to look at overall mortality. As we began to work with the model, looking at quality-adjusted life-years, for example, there is a statistically significant benefit in the selective treatment of claudicants. The comprehensive strategy where all claudicants would be identified prior to entry into a program, and treated, probably will never reach a statistical significance no matter how we vary the probability parameters.

Dr Hingorani. And what was the cost per quality life per year?

Dr White. It is about $70,000.

Dr John Blebea (Philadelphia, Pa). It appears to me that you are presenting an association and not necessarily a causal relationship. Do these patients fail cardiac rehab because specifically of limiting claudication, or was the ABI [ankle-brachial index] and claudication simply a surrogate marker of more advanced disease? You are also proposing a very aggressive interventional policy on the assumption that mortality will subsequently be decreased. However, if lower extremity occlusive disease is but a marker of more severe systemic atherosclerotic disease, will doing a bypass in the legs really impact on their longevity and cardiac prognosis?

Dr White. Those are two great questions, John. The answer appears to be that if we allow these patients to successfully complete their cardiac rehabilitation, then there will be a reduction in mortality, at least as predicted by all the meta-analyses available on cardiac rehabilitation.

As to your first question, there are a plethora of articles trying to ascertain why patients don't return for cardiac rehabilitation. Claudication as sole cause has never been evaluated. Although ABI and WIQ [Walking Impairment Questionnaire] scores do seem to be indirect measures, a direct survey of patients yields no greater information. Therefore, because the walking impairment questionnaire has such great statistical correlation with walking distance and other outcomes, we used that as our major parameter for ascertaining the presence of peripheral arterial disease and symptoms of intermittent claudication.

Dr Marc Mitchell (Jackson, Miss). I enjoyed your presentation and have a comment. This situation is not just limited to patients with cardiac disease. We now have a handful of patients that underwent joint replacement surgery and were unable to rehabilitate because of vascular disease. Once we treated their peripheral arterial disease, they were able to go on with their orthopedic rehabilitation. This problem is probably more widespread than we really think.

Dr White. Thank you for those comments and I completely agree.

Dr George Andros (Van Nuys, Calif). As surgeons, we think of interventions in terms of endovascular and open; but a supervised walking program is an intervention as well. What you are asking these people to do is to walk for their hearts instead of their legs. It has been well documented that supervised walking programs ameliorate claudication symptoms as well as increase walking distance and ABIs. If patients don't experience cardiac symptoms before the vascular claudication symptoms occur during exercise, what is the harm in having the patient undertake a peripheral arterial walking program first? If the legs don't improve enough, both subjectively and objectively, to allow sufficient cardiac exercise with its accrued benefits then you can always proceed with leg revascularization. Bear in mind, however, as the Oxford University group showed many years ago, endoluminal therapy may not be as durable in achieving sustained improvements in claudication as a walking program. You might be back where you started.

Dr White. That is a very insightful observation. We did look at, for the purposes of the Markov model, a combined cardiac and vascular rehabilitation program, which clearly dominates all other strategies.